

**Abstract**

A portion of an ion optical column is formed using a dielectric bushing to support metallic optical elements, electrically isolate them, and form a vacuum chamber around those elements. In particular, the dielectric bushing is suitable for forming an ion gun vacuum chamber in which are contained an emitter assembly and other optical elements, the gun vacuum chamber preferably being vacuum sealable separately from the system vacuum chamber. A compact ion column includes, within the system vacuum chamber, an automated variable aperture drive mechanism and a gun chamber vacuum isolation valve activation mechanism. Including these mechanisms within the vacuum chamber facilitates the design of multi-beam systems by eliminating mechanical feedthroughs that would interfere with the placement of other components in the vacuum chamber.